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Docket No.
INTL-0427-US (P9133)

TO THE ASSISTANT COMMISSIONER FOR PATENTS

JC982 U.S. PTO 09/628759 07/31/00

Transmitted herewith for filing under 35 U.S.C. 111 and 37 C.F.R. 1.53 is the patent application of:

CHI M. CHEUNG

For: **COMMUNICATING INFORMATION FROM AN IMAGING DEVICE TO A PROCESSOR-BASED SYSTEM**

Enclosed are:

- ☒ Certificate of Mailing with Express Mail Mailing Label No. **EL594060392US**
- ☒ **Three (3)** sheets of drawings.
- ☐ A certified copy of a application.
- ☒ Declaration ☒ Signed. ☐ Unsigned.
- ☒ Power of Attorney
- ☐ Information Disclosure Statement
- ☐ Preliminary Amendment
- ☒ Other: **Recordation Form Cover Sheet; Assignment and check for $40.**

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra		Rate	Fee
Total Claims	26	- 20 =	6	x	$18.00	$108.00
Indep. Claims	4	- 3 =	1	x	$78.00	$78.00
Multiple Dependent Claims (check if applicable) ☐						$0.00
					BASIC FEE	$690.00
					TOTAL FILING FEE	$876.00

- ☒ A check in the amount of **$876.00** to cover the filing fee is enclosed.
- ☒ The Commissioner is hereby authorized to charge and credit Deposit Account No. **20-1504** as described below. A duplicate copy of this sheet is enclosed.
  - ☐ Charge the amount of as filing fee.
  - ☒ Credit any overpayment.
  - ☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
  - ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

Dated: **July 31, 2000**

Signature

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21906
PATENT TRADEMARK OFFICE

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Customer No. 21906

INTL-0427-US
(P9133)

APPLICATION

FOR

UNITED STATES LETTERS PATENT

TITLE: COMMUNICATING INFORMATION FROM AN IMAGING DEVICE TO A PROCESSOR-BASED SYSTEM

INVENTOR: CHI M. CHEUNG

Express Mail No.: EL594060392US

Date: July 31, 2000

COMMUNICATING INFORMATION FROM AN IMAGING DEVICE TO A PROCESSOR-BASED SYSTEM

Background

This invention relates generally to processor-based imaging devices such as digital cameras.

Digital cameras may be tethered to processor-based systems. In one example, the tether may be a cable in accordance with the Universal Serial Bus (USB) standard. Video frames captured in the digital camera may be provided over the bus to the processor-based system. In the processor-based system, the frames may be stored or otherwise manipulated or analyzed.

A number of motion detection systems are utilized with processor-based systems. Motion detection systems may be utilized to control video capture devices for surveillance purposes as one example. As another example, video cameras may be controlled in response to motion to transmit video for incorporation into web sites through so-called "web cams".

Generally, motion detection systems for digital still or video cameras utilize a motion detector that may be an infrared sensor. The operation of the camera may be controlled by the detection of motion to avoid unnecessarily capturing video when no action is occurring. However, there is a continuing need for a better way to

control the operation of digital cameras that have motion detection.

Brief Description of the Drawings

Figure 1 is a schematic depiction of one embodiment of the present invention;

Figure 2 is a block diagram of a video capture device in accordance with one embodiment of the present invention;

Figure 3 is a block diagram of a processor-based system coupled to a video capture device in accordance with one embodiment of the present invention; and

Figure 4 is a flow chart for a software stored on the processor-based device in accordance with one embodiment of the present invention.

Detailed Description

Referring to Figure 1, a digital imaging device and motion detector 10 may be coupled by a bus 12 to a processor-based system 14. The processor-based system 14 may be a desktop computer, a laptop computer, an appliance, a handheld device or a processor-based telephone. The bus 12 may be compliant with the Universal Serial Bus specification. See Universal Serial Bus Revision 2.0 specification dated April 27, 2000 available from USB Developers, Portland, Oregon 97221.

The digital imaging device and motion detector 10 may include a digital still or video camera or scanner as two

examples. The digital imaging device and motion detector 10 includes a motion detector such as an infrared motion detector. The motion detector may be integral with or separate from the imaging device.

The digital imaging device and motion detector 10 captures a depiction of a captured image including a plurality of pixels that make up a digital frame. A plurality of frames of video may be captured and transmitted over the bus 12 to the processor-based system 14.

Information about whether or not motion was detected may be added to the video stream that is transmitted between the imaging device and motion detector 10 and the processor-based system 14. In one embodiment of the present invention, streaming video may be forwarded over the bus 12 in the form of a series of packetized frames. Each frame may be formed of a plurality of digital packets. The packets may include information about the particular colors and intensities captured for one or more pixels by the imaging device and motion detector 10.

A packet header, for example, may include information about the captured intensity of one or more pixels and color information. The brightness information may include a plurality of bits including a most significant bit and a least significant bit. Information about whether or not motion was detected may be provided within a given packet

in place of the least significant bit of brightness information, in one embodiment. In other cases, other bits of video data may be replaced with information about whether or not motion was detected. In still other cases, the video stream may accommodate an additional bit representing the motion information.

The motion bit may be provided with each frame or may be provided with a plurality of pixels making up a particular frame. As another example, the motion bit may be provided as the least significant bit in the brightness data for one particular pixel of each frame. That is, the data associated with the same pixel in each frame is modified to include the motion bit.

Referring to Figure 2, the digital imaging device and motion detector 10, in accordance with one embodiment of the present invention, may include an optics unit 202 coupled to a digital imaging array or imager 204. The imager 204 is coupled to a bus 214. The optics unit 202 focuses an optical image onto the focal plane of the imager 204. The image data (e.g., frames) generated by the imager 204 may be transferred to a random access memory (RAM) 206 (through memory controller 208) or flash memory 210 (through memory controller 212) via the bus 214. In one embodiment of the present invention, the RAM 206 is a non-volatile memory.

The imaging device and motion detector 10 may also include a compression unit 216 that interacts with the imager 204 to compress the size of a generated frame before storing it in a camera memory (RAM 206 and/or flash memory 210). To transfer a frame of data to the processor-based system 14, the digital imaging device and motion detector 10 may include a serial bus interface 218 to couple the memory (RAM 206 and flash memory 210) to a serial bus 12. One illustrative serial bus is the Universal Serial Bus (USB).

The digital imaging device and motion detector 10 may also include a processor 222 coupled to the bus 214 via a bus interface 224. In some embodiments, the processor 222 interacts with the imager 204 to adjust image capture characteristics.

The serial bus interface 218 packetizes the captured pixel data and forms frames made up of pixel information including intensity information. The serial bus interface 218 may substitute a bit indicative of the information received, over the bus interface 228, from the infrared motion detector 226. That is, the infrared motion detector 226 may send a signal indicating, in each frame interval, whether or not motion was detected. Conventionally, frames are generated at a frame rate of thirty frames per second for a frame interval of 1/30 second.

If motion is detected, that information may be provided by the processor 222 to the serial bus interface 218 for incorporation within the packetized video data. In one embodiment of the present invention, the least significant bit of the brightness information for at least one pixel of each frame may be removed and replaced by a bit indicative of whether or not motion was detected during the interval of a particular frame.

As a result, the motion information may be transmitted to the processor-based system 14 as part of the ongoing video stream. In the processor-based system 14, a decision may be made, upon detection of the motion bit, as to what action should be taken with the video stream that is being received. In one embodiment of the present invention, if the motion bit indicates motion, the captured video may be stored on the processor-based system 14. If the motion bit indicates no motion, the video may be discarded. Thus, a surveillance or motion activated video storage system may be implemented.

Referring to Figure 3, the processor-based system 14 may include a processor 300 coupled to a north bridge 302. The north bridge 302 may be coupled to a display controller 306 and a system memory 304. The display controller 306 may in turn be coupled to a display 308. The display 308 may be a computer monitor, a television screen, or a liquid crystal display, as examples.

The north bridge 302 is also coupled to a bus 310 that is in turn coupled to the south bridge 312. The south bridge 312 may be coupled to a hub 316 that couples a hard disk drive 318. The hard disk drive 318 may store software 400, described hereinafter.

The south bridge 312 may also be coupled to a USB hub 314. The hub 314 in turn is coupled to the serial bus interface 218 of the digital imaging device and motion detector 10.

The south bridge 312 also couples a bus 320 that is connected to a serial input/output (SIO) device 322 and a basic input/output system (BIOS) memory 328. In one embodiment of the present invention, the SIO device 322 is coupled to a modem 326 for Internet access. In this way, the information may be provided from the digital imaging device and motion detector 10 to the processor-based system 14 and ultimately uploaded to the Internet. In addition, the SIO device 322 may be coupled to an input/output device 324 such as a mouse, a keyboard, a touch screen or the like.

The motion detection software 400, shown in Figure 4 and stored on the hard disk drive 318 in one embodiment of the present invention, may initially detect whether motion has been identified as indicated in diamond 402. This may be accomplished by depacketizing the packetized frames received from the digital imaging device and motion

detector 10. In particular, the bit indicative of motion, that has been incorporated into the video data stream, may be located and detected. If the bit indicates that motion was detected, the system 14 may enter the capture mode as indicated in block 404. In a capture mode, the particular video frame may actually be stored, as one example, on the processor-based system 14, for example on the hard disk drive 318.

After entering the capture mode and storing a particular frame, a check at diamond 406 determines whether motion is still detected. If so, the flow iterates and another frame is captured. Otherwise, the flow ends.

The packetized data from the digital video imaging device and motion detector 10 may be depacketized and displayed line by line on the processor-based system 14. The depacketization may be accomplished by a video driver associated with the processor-based system 14. That driver may be dedicated to handling the video from the device 10. In one embodiment of the present invention, the header for a particular pixel is decoded to obtain the motion bit. In other embodiments, the motion bit may be associated in a variety of packet headers or payload locations for each frame.

While the present invention has been described with respect to a limited number of embodiments, those skilled in the art will appreciate numerous modifications and

variations therefrom. It is intended that the appended claims cover all such modifications and variations as fall within the true spirit and scope of this present invention.

What is claimed is:

1. A method comprising:

detecting motion within an imaged scene;

capturing a digital representation of said scene in an imaging device;

encoding information in said digital representation to indicate whether motion was detected; and

transmitting said digital representation from said imaging device to a processor-based system over a bus.

2. The method of claim 1 including transmitting said digital representation over a Universal Serial Bus.

3. The method of claim 1 wherein capturing includes capturing image data representing said scene and wherein encoding information in said digital representation includes encoding information in place of image data.

4. The method of claim 3 including replacing intensity information in said digital representation with said motion information.

5. The method of claim 4 including providing a bit in said digital representation to indicate whether motion was detected.

6. The method of claim 1 including decoding said digital representation and determining whether motion was detected.

7. The method of claim 6 including controlling the storage of said digital representation on the processor-based system based on whether motion was detected.

8. The method of claim 1 wherein encoding information in said digital representation includes forming a plurality of packets containing image data and replacing image data in one of said packets with information about whether motion was detected.

9. An article comprising a medium storing instructions that enable a processor-based system to:

detect motion within an imaged scene;

capture a digital representation of said scene in an imaging device;

encode information in said digital representation to indicate whether motion was detected; and

transmit said digital representation from said imaging device to a processor-based system over a bus.

10. The article of claim 9 further storing instructions that enable the processor-based system to

transmit said digital representation over a Universal Serial Bus.

11. The article of claim 9 further storing instructions that enable the processor-based system to capture image data representing said scene and encode information in said digital representation in place of image data.

12. The article of claim 11 further storing instructions that enable the processor-based system to replace intensity information in said digital representation with said motion information.

13. The article of claim 12 further storing instructions that enable the processor-based system to provide a bit in said digital representation to indicate whether motion was detected.

14. The article of claim 9 further storing instructions that enable the processor-based system to decode said digital representation and determine whether motion was detected.

15. The article of claim 14 further storing instructions that enable the processor-based system to

control the storage of said digital representation on the processor-based system based on whether motion was detected.

16. The article of claim 9 further storing instructions that enable the processor-based system to form a plurality of packets containing image data and replace image data in one of said packets with information about whether motion was detected.

17. A digital imaging device comprising:

a motion detector;

an imaging element to capture image data representing an image; and

a serial bus interface, coupled to said imaging element and said motion detector, said serial bus interface forms a plurality of packets containing said image data for transmission over a bus, serial bus interface incorporates information about whether motion was detected into said packets containing said image data.

18. The device of claim 17 wherein said serial bus interface is coupled to a Universal Serial Bus.

19. The device of claim 17 including a processor-based device coupled to the bus, said motion detector,

serial bus interface and imaging element also coupled to said bus.

20. The device of claim 17 wherein said serial bus interface forms said image data into packets including both a payload and a header.

21. The device of claim 20 including intensity information in said packets, said intensity information having a least significant bit.

22. The device of claim 21 including replacing said least significant bit with a bit indicating whether motion was detected by said motion detector.

23. A system comprising:

a digital imaging device including a motion detector and a packetizer that converts image data captured by said imaging device into a plurality of packets;

said motion detector coupled to said imaging device, said image device generating motion data, said packetizer packetizing said motion data;

a processor-based device; and

a bus coupling said processor-based device and said imaging device.

24. The system of claim 23 wherein said bus is a Universal Serial Bus.

25. The system of claim 23 wherein said packetizer inserts motion data received from said motion detector into packets including said image data.

26. The system of claim 25 wherein said packetizer inserts a bit indicating whether motion was detected into a packet including image data to indicate whether motion was detected in that image data.

COMMUNICATING INFORMATION FROM AN
IMAGING DEVICE TO A PROCESSOR-BASED SYSTEM

Abstract of the Disclosure

Image data from a capture device may be streamed from the capture device to a processor-based system. A motion detector associated with the capture device may provide a bit that is incorporated into the image data stream in place of image data, in one embodiment of the present invention. This bit may be decoded in a processor-based system to control how the image data stream, received from the capture device, is handled.

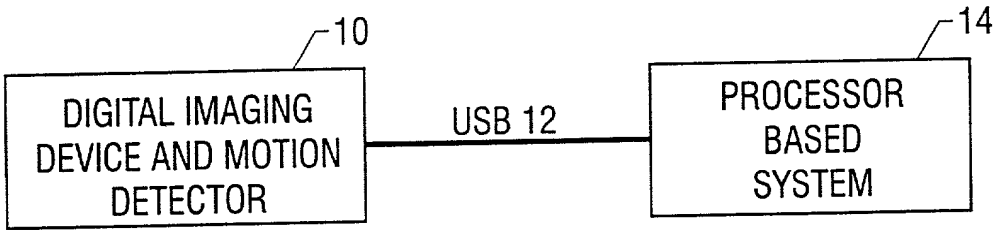
10
DIGITAL IMAGING DEVICE AND MOTION DETECTOR
USB 12
14
PROCESSOR BASED SYSTEM

FIG. 1

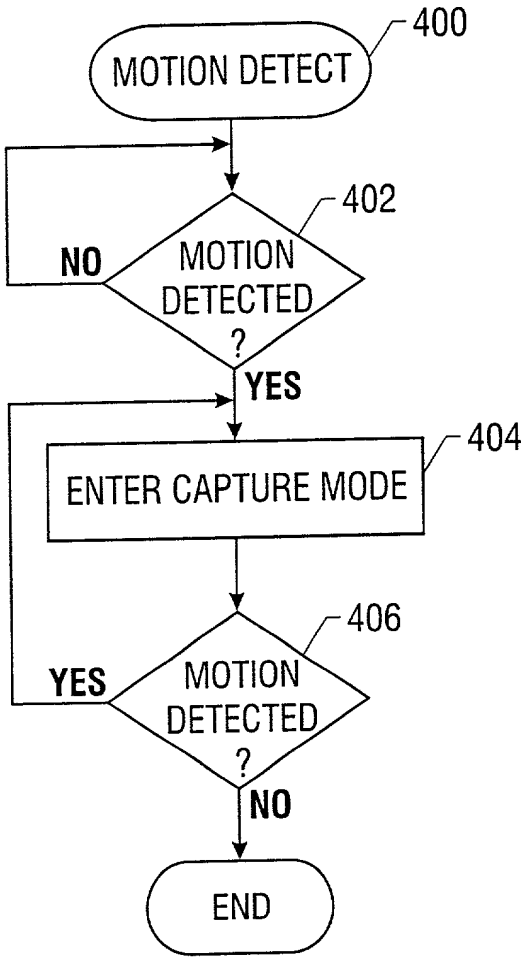
400
MOTION DETECT
402
NO
MOTION DETECTED ?
YES
404
ENTER CAPTURE MODE
406
YES
MOTION DETECTED ?
NO
END

FIG. 4

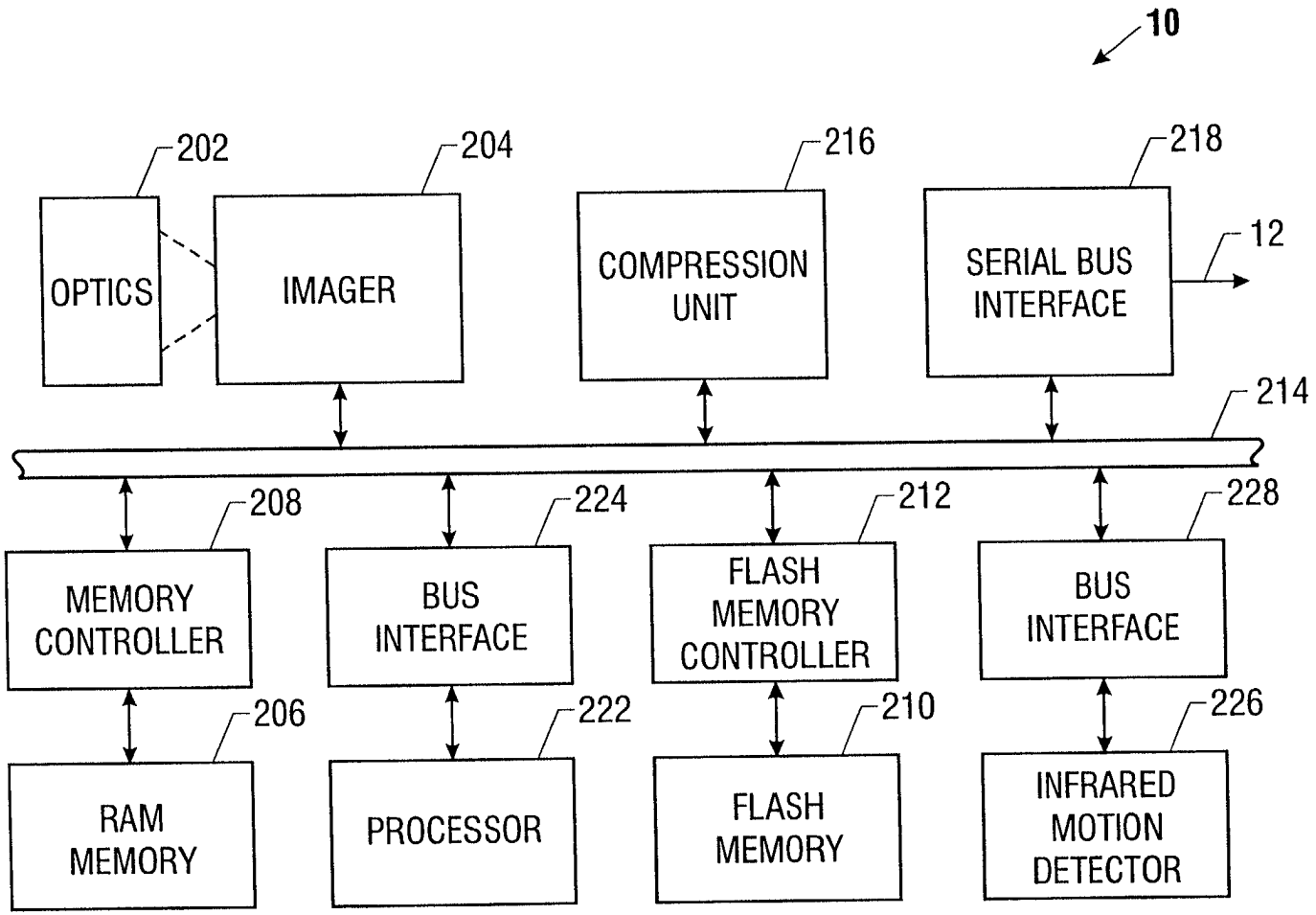
10
202
204
216
218
OPTICS
IMAGER
COMPRESSION UNIT
SERIAL BUS INTERFACE
12
214
208
224
212
228
MEMORY CONTROLLER
BUS INTERFACE
FLASH MEMORY CONTROLLER
BUS INTERFACE
206
222
210
226
RAM MEMORY
PROCESSOR
FLASH MEMORY
INFRARED MOTION DETECTOR

FIG. 2

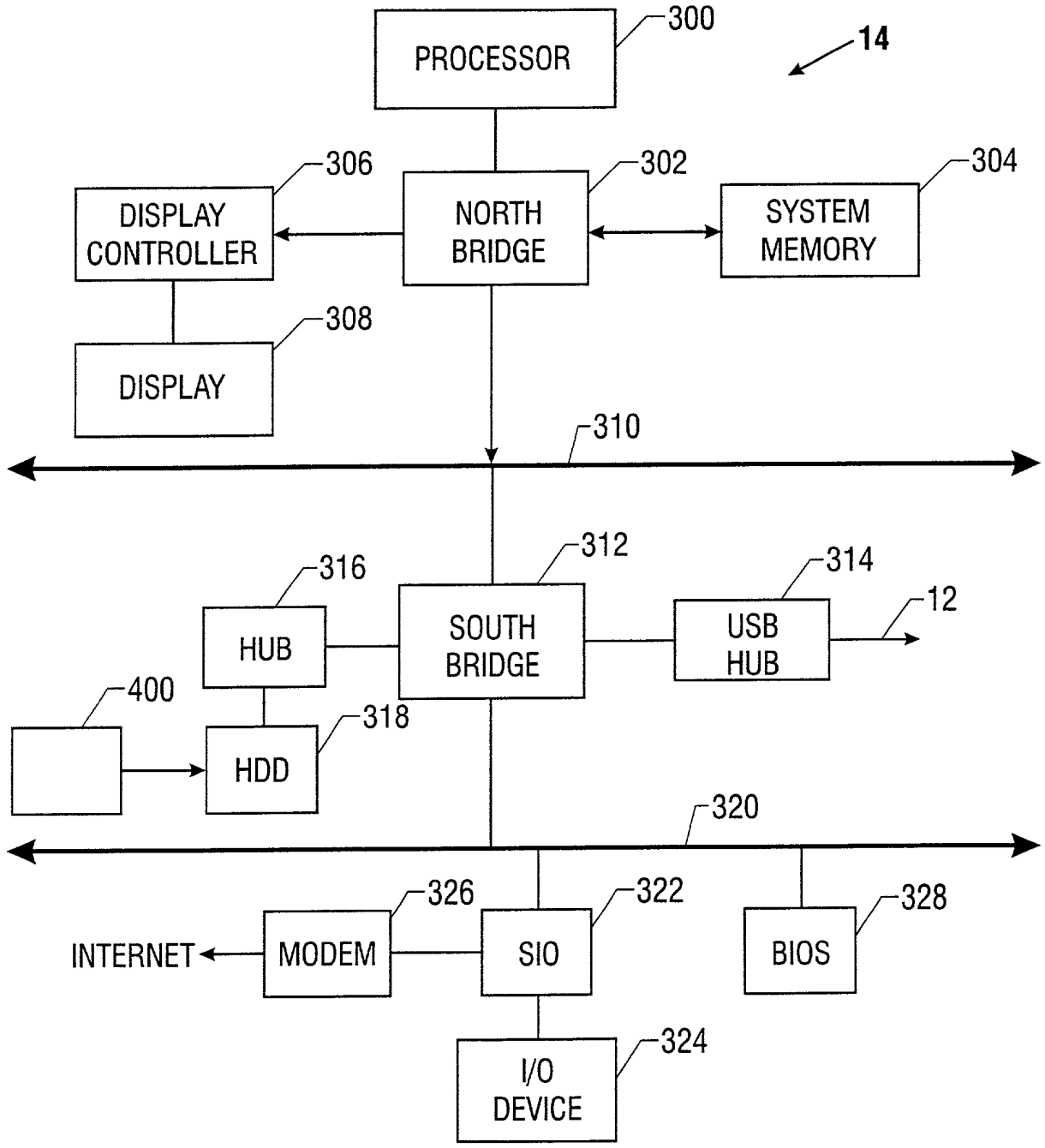
PROCESSOR
300
14
306
302
304
DISPLAY CONTROLLER
NORTH BRIDGE
SYSTEM MEMORY
308
DISPLAY
310
312
316
314
12
HUB
SOUTH BRIDGE
USB HUB
400
318
HDD
320
326
322
328
INTERNET
MODEM
SIO
BIOS
324
I/O DEVICE

FIG. 3

Attorney's Docket No.: INTL-0427 -US (P9133) PATENT

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

COMMUNICATING INFORMATION FROM AN IMAGING DEVICE TO A PROCESSOR-BASED SYSTEM

the specification of which

X	is attached hereto.
	was filed on _____ as
	United States Application Number _____
	or PCT International Application Number _____
	and was amended on _____ (if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above. I do not know and do not believe that the claimed invention was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months (for a utility patent application) or six months (for a design patent application) prior to this application.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s):			Priority Claimed	
Number	(Country)	(Day/Month/Year Filed)	Yes	No
Number	(Country)	(Day/Month/Year Filed)	Yes	No
Number	(Country)	(Day/Month/Year Filed)	Yes	No

I hereby claim the benefit under title 35, United States Code, Section 119(e) of the United States provisional application(s) listed below:

(Application Number)	(Filing Date)
(Application Number)	(Filing Date)

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

(Application Number)	Filing Date	(Status-patented, pending, abandoned)
(Application Number)	Filing Date	(Status-patented, pending, abandoned)

I hereby appoint Timothy N. Trop, Reg. No. 28,994; Fred G. Pruner, Jr., Reg. No. 40,779 and Dan C. Hu, Reg. No. 40,025 my patent attorneys, of TROP, PRUNER & HU, P.C., with offices located at 8554 Katy Freeway, Ste. 100, Houston, TX 77024, telephone (713) 468-8880, and Mirho, Charles A.; Registration No. 41,199; Novakoski, Leo V.; Registration No. 37,198; Reynolds, Thomas C.; Registration No. 32,488; Seddon, Kenneth M.; Registration No. 43,105; Seeley, Mark; Registration No. 32,299; Skabrat, Steven P.; Registration No. 36,279; Skaist, Howard A.; Registration No. 36,008; Su, Gene I.; Registration No. 45,140; Wells, Calvin E.; Registration No. 43,256; Werner, Raymond J.; Registration No. 34,752; Winkle, Robert G.; Registration No. 37,474; and Young, Charles K.; Registration No. 39,435 my patent attorneys, of INTEL CORPORATION with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

Send correspondence to Timothy N. Trop, TROP, PRUNER & HU, P.C., 8554 Katy Freeway, Ste. 100, Houston, TX 77024 and direct telephone calls to Timothy N. Trop, (713) 468-8880.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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